



Lowell Regional Wastewater
451 First Street Boulevard
Lowell, MA 01854
Attn: Tom Kawa

August 11, 2017

Dear Mr. Kawa,

Enclosed please find the toxicological evaluation and chemical analyses report for the effluent sample received on July 10th, 2017. This is your third quarter 2017 bioassay. Please call me at (401) 353-3420 if you have any questions.

Sincerely,

Michael McCallum
Technical Laboratory Director

NEW ENGLAND TESTING LABORATORY, INC.

59 Greenhill St., West Warwick, RI 02893

(401) 353-3420

TOXICOLOGICAL EVALUATION
AND CHEMICAL ANALYSES
OF EFFLUENT:
NPDES Permit # MA0100633
Third Quarter 2017 Sample
Lowell

Prepared For:
Lowell Regional Wastewater
451 First Street Boulevard
Lowell, MA 01854

August 11, 2017

By
New England Testing Laboratory, Inc.
59 Greenhill Street
West Warwick, Rhode Island 02893

NETLAB CASE NUMBER: 7G10069



New England Bioassay

A Division of GZA



CHRONIC AQUATIC TOXICITY TEST REPORT

**Lowell Regional Wastewater Utilities
Lowell, Massachusetts**

Ceriodaphnia dubia Survival and Reproduction Test – EPA 1002.0

EPA 821-R-02-013, "Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Water to Freshwater Organisms", Fourth Edition

GEOTECHNICAL

ENVIRONMENTAL

ECOLOGICAL

WATER

CONSTRUCTION
MANAGEMENT

Test Start Date: 7/11/17

Test Period: July 2017

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Manchester, CT 06042
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Report Prepared by:
New England Bioassay
A Division of GZA GeoEnvironmental, Inc.
77 Batson Drive
Manchester, CT 06040

NEB Project Number: 05.0044476.00

Report Date: August 7, 2017

Report Submitted to:

New England Testing Laboratories
59 Greenhill Street
West Warwick, RI02893

Sample ID: Effluent

This report shall not be reproduced, except in its entirety, without written approval of New England Bioassay (NEB). NEB is the sole authority for authorizing edits or modifications to the data contained in this report. Test results relate only to samples analyzed. Please contact the Lab Manager, Kimberly Wills, at 860-858-3153 or kimberly.wills@gza.com if you have any questions concerning these results.

NEW ENGLAND BIOASSAY, A DIVISION OF GZA – EPA SUMMARY SHEET

Facility Name: Lowell RWWU Test Start Date: 7/11/17
 NPDES Permit Number: MA0100633 Outfall Number: _____

<u>Test Type</u>	<u>Test Species</u>	<u>Sample Type</u>	<u>Sample Method</u>
<input type="checkbox"/> Acute	<input type="checkbox"/> Fathead Minnow	<input type="checkbox"/> Prechlorinated	<input type="checkbox"/> Grab
<input type="checkbox"/> Chronic	<input checked="" type="checkbox"/> Ceriodaphnia Dubia	<input checked="" type="checkbox"/> Dechlorinated	<input checked="" type="checkbox"/> Composite
<input checked="" type="checkbox"/> Modified	<input type="checkbox"/> Daphnia Pulex	<input type="checkbox"/> Unchlorinated	<input type="checkbox"/> Flow-thru
(Chronic reporting LC50 values)	<input type="checkbox"/> Mysid Shrimp	<input type="checkbox"/> Chlorinated	<input type="checkbox"/> Other
<input type="checkbox"/> 24-Hour Screening	<input type="checkbox"/> Sheepshead		
	<input type="checkbox"/> Menidia		
	<input type="checkbox"/> Sea Urchin	TRC conc. <u>0.010</u> mg/L	
	<input type="checkbox"/> Selenastrum		
	<input type="checkbox"/> Other _____		

Dilution Water

☐ Receiving water collected at a point immediately upstream of or away from the discharge;
 (Receiving water name and sampling location: Merrimack River -see COC)
☐ Alternate Surface Water of known quality and a hardness to generally reflect the characteristics
 of the receiving water; (Surface water name: _____)
☒ Synthetic water prepared using either Millipore Mill-Q or equivalent deionized water and
 reagent grade chemicals; or deionized water combined with mineral water;
☐ Artificial sea salts mixed with deionized water;
☐ Other _____

Effluent Sampling Date (s): 7/9/17 7/11/17 7/13/17

Effluent Concentrations Tested (in%): 0 6.25 12.5 25 50 100
 * (Permit Limit Concentration): ≥100% (LC50)

Was effluent salinity adjusted? No If yes, to what value? N/A ppt

Reference Toxicant test date: 7/5/17 Reference Toxicant Test Acceptable: Yes ☒ No ☐

Age and Age Range of Test Organisms < 24 hours Source of Organisms NEB Lab

TEST RESULTS & PERMIT LIMITS

Test Acceptability Criteria

A. Synthetic Water Control

Mean Control Survival: 100% Mean Control Reproduction: 23.3 young/female

B. Receiving Water Control

Mean Control Survival: 100% Mean Control Reproduction: 25.4 young/female

C. Lab Culture Control Yes ☐ No ☒

Mean Control Survival: N/A Mean Control Reproduction: N/A

D. Thiosulfate Control Yes ☐ No ☒

Mean Control Survival: N/A Mean Control Reproduction: N/A

Test Variability

Test PMSD (growth) <u>N/A</u>	Upper and Lower PMSD bound <u>N/A</u>	low <input type="checkbox"/> in-bounds <input type="checkbox"/> high <input type="checkbox"/>
Test PMSD (reprod.) <u>28.8%</u>	Upper and Lower PMSD bound <u>13-47%</u>	low <input type="checkbox"/> in-bounds <input checked="" type="checkbox"/> high <input type="checkbox"/>

Permit Limits & Test Results

	<u>Limits</u>		<u>Results</u>
LC50	<u>≥100%</u>	LC50	<u>>100%</u>
		Upper Value	<u>±∞</u>
		Lower Value	<u>100%</u>
		Data Analysis	
		Method Used	<u>Graphical</u>
A-NOEC	<u>N/A</u>	A-NOEC	<u>100%</u>
C-NOEC	<u>monitoring only</u>	C-NOEC	<u><6.25%</u>
		LOEC	<u>6.25%</u>
IC25		IC25	<u>3.72%</u>
IC50	<u>N/A</u>	IC50	<u>62.5%</u>

PMSD Comparison Discussion (Test Variability/Sensitivity)

Reproduction

- ☐ 1. PMSD exceeds upper bounds. Test results are highly variable and may not be sensitive enough to determine the presence of toxicity at the permit limit concentration (PLC).
- ☐ 1a. Test results indicate the discharge is not toxic at the PLC. Test is not sufficiently sensitive and must be repeated within 30 days of the initial test completion date using fresh samples.
- ☐ 1b. Test results indicate the discharge is toxic at the PLC. Test results are considered acceptable and the test does not have to be repeated.
- ☒ 2. The PMSD falls within the upper (47%) and lower (13%) bounds. Results are reportable.
- ☐ 3. PMSD falls below the lower bound test variability criterion. The test is very sensitive. The relative percent difference (RPD) between the control and each treatment was calculated and compared to the lower PMSD boundary
- ☐ 3a. The RPD values for each concentration fall below the lower bound. The differences observed in this test are considered statistically insignificant.
- ☐ 3b. The RPDs for the following concentrations are above the lower bound _____.
The results at these concentrations are considered statistically significantly lower than controls.

Concentration-Response Evaluation

Survival: No concentration-response curve – no mortality observed at any concentration.

Reproduction: The concentration-response relationship observed in this data set corresponds to the following item number in Chapter Four of “Method Guidance and Recommendations for Whole Effluent Toxicity (WET) Testing (40 CFR Part 136)”, EPA 821-B-00-004, July 2000: # 1 Ideal concentration-response relationship.

The concentration-response relationship was reviewed according to the above guidance document and the following determination was made:

Survival Reprod.

- | | | |
|-------------------------------------|-------------------------------------|---|
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 1. Results are reliable and reportable. |
| <input type="checkbox"/> | <input type="checkbox"/> | 2. Results are anomalous. An explanation is provided in the body of the report. |
| <input type="checkbox"/> | <input type="checkbox"/> | 3. Results are inconclusive. A retest with fresh samples is required. An explanation is provided in the body of the report. |

Whole Effluent Toxicity Testing Report Conclusions and Notes

Client Name/Project: NET/Lowell Regional Wastewater Utilities Test Date: 7/11/17

Sample ID: Effluent

Your results were as follows:

☒ Passed all whole effluent toxicity permit limits

☐ Failed the following permit limit(s): ☐ LC50 ☐ C-NOEC (monitoring only)
Please proceed according to the instructions in your permit.

☐ Original Test Invalid – **Valid retest performed. Both test and retest results are attached.**

☐ A retest using fresh samples must be performed within 30 days of the initial test completion date (____) due to the test condition described below. See next page for further explanation.

☐ Test Invalid due to: ☐ Diluent toxicity ☐ Synthetic control toxicity

☐ Test not sufficiently sensitive. PMSD exceeds upper bound.

☐ Results are inconclusive due to an unusual concentration-response relationship.

☐ Available information is insufficient to determine whether this test passed or failed. Please compare results to your permit limits. Please submit a current copy of your permit to the NEB Lab so that we can determine the status of future tests results and help ensure your compliance with permit requirements.

☐ Additional testing for metals was required on the second and third effluent samples due to the following:

☐ Renewal sample(s) were of sufficient potency to cause lethality to 50% or more of the test organisms as follows: Effluent #: ☐ 2 ☐ 3 Concentration: ☐ 6.25% ☐ 12.5% ☐ 25% ☐ 50% ☐ 100% ☐ ____%

☐ The test failed to meet its permit limit for: ☐ LC50 ☐ C-NOEC

Diluent Toxicity:

☐ Testing ☐ will be or ☐ has been performed according to the Case 1 Protocols outlined in the attached copy of EPA-New England's species-specific, self-implementing policy for alternate dilution water.

☐ Retesting ☐ will be or ☐ has been performed according to the Case 1 Protocols outlined in the attached copy of EPA-New England's species-specific, self-implementing policy for alternate dilution water.

☐ This is your _____ case of dilution water toxicity. Please proceed according to the Case 2 Protocols outlined in the attached copy of EPA-New England's species-specific, self-implementing policy for alternate dilution water. The alternate dilution water you select for future tests for this species should be described as follows: "synthetic laboratory water made up according to EPA's toxicity test protocols, by adding specified amounts of salts into deionized water in order to match the hardness of our receiving water." Writing this letter should help you to avoid retests in the future.

Sampling Requirements:

A minimum of 3 samples were collected. ☒ Yes. ☐ No. See explanation on next page.

Samples were first used within 36 hours of collection. ☒ Yes. ☐ No. See explanation on next page.

Dechlorination Procedures: Chlorine was measured using 4500 CL-G DPD Colorimetric Method.

☒ Dechlorination was not required.

☐ Sample was dechlorinated to _____ mg/L by adding sodium thiosulfate to the sample prior to test initiation. A dechlorinated control of diluent water spiked with sodium thiosulfate equal in proportion to the amount added to the effluent sample was included in the test series.

☐ Chlorine elevated due to interference. Chlorine was _____ mg/L after interference check.

☐ Total Residual Chlorine was re-measured following aeration, and was found to be _____ mg/L.

WHOLE EFFLUENT TOXICITY TEST REPORT CERTIFICATION (Permittee)

I certify under penalty of law that this document and all ATTACHMENTS were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Executed on _____

[Date]

[Authorized Signature]

[Print or Type Name and Title]

[Print or Type the Permittee's Name]

[Print or Type the NPDES Permit No.]

Since the WET test and report check is complicated, the New England Bioassay Aquatic Toxicity Laboratory has certified the validity of the WET test data in the section below. Please note that this does not relieve the permittee from its responsibility to sign and certify the report under 40 C.F.R. S 122.41(k).

WHOLE EFFLUENT TOXICITY TEST REPORT CERTIFICATION (Bioassay Laboratory)

I certify under penalty of law that this document and all ATTACHMENTS were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Executed on _____

[Date]

[Authorized Signature]

Kim Wills, Laboratory Manager

[Print or Type Name and Title]

New England Bioassay

[Print or Type Name of Bioassay Laboratory]

24. Telephone Contacts

If you have questions, please contact Joy Hilton, Water Technical Unit, at (617) 918-1877 or David McDonald, Ecosystem Assessment Unit, at (617) 918-8609.

NEW ENGLAND BIOASSAY TOXICITY DATA FORM
CHRONIC COVER SHEET

CLIENT: New England Testing Laboratory
 ADDRESS: 59 Greenhill Street
West Warwick, RI 02893
 SAMPLE TYPE: Lowell RWF Effluent
 DILUTION WATER: Laboratory Synthetic Soft Water

C.dubia TEST ID # 17-1015
 COC # c37-2675/76
 PROJECT # 05.0044476.00

INVERTEBRATES

TEST SET UP (TECH INIT) TBP
 TEST SPECIES *Ceriodaphnia dubia*
 NEB LOT# Cd17(123 S)
 AGE < 24 hours
 TEST SOLUTION VOLUME (mls) 15
 NO. ORGANISMS PER TEST CHAMBER 1
 NO. ORGANISMS PER CONCENTRATION 10

Laboratory Control Water (SRCF)

Batch Number	Hardness mg/L CaCO ₃	Alkalinity mg/L CaCO ₃
C37-S013	46	30

	DATE	TIME
TEST START:	7/11/17	1118
TEST END:	7/17/17	1111

Results of *Ceriodaphnia dubia* Chronic Test

95% Confidence
Limits

48 Hour LC50	>100%	100%±∞
7 Day LC50	>100%	100%±∞
Survival NOEC	100%	
Survival LOEC	>100%	
Reproduction NOEC	<6.25%	
Reproduction LOEC	6/25%	
Reproduction IC ₂₅	3.72%	

NOEC: NO OBSERVABLE EFFECT CONCENTRATIC LOEC: LOWEST OBSERVABLE EFFECT CONCENTRATION

Comments:

REVIEWD BY:



DATE:

8/9/17

NEW ENGLAND BIOASSAY - CHRONIC TOXICITY TEST BROOD DATA SHEET

FACILITY NAME & ADDRESS: Lowell Regional Wastewater Utilities First Street Boulevard, Lowell, MA 01850			
NEB PROJECT NUMBER: 05.0044476.00		NEB TEST NUMBER: 17-1015	COC # c37-2675/76
TEST ORGANISM: <i>Ceriodaphnia dubia</i>		AGE: <24 hours	Lot # Cd17(123 S)
START DATE: 7/11/17	TIME: 1118	END DATE: 7/17/17	TIME: 1111

Effluent Concentration	Culture Lot# Cd17(123 S)											Total Live Young	# Live Adults	Analyst- Transfer	Analyst- Counts
	Cup #	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10				
	Day Number	Replicate													
		A	B	C	D	E	F	G	H	I	J				
NEB Lab Synthetic Diluent	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		10	TBP	
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		10	KO	
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10	CW	
	3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10	CB	CB
	4	7	6	6	7	6	1	4	5	5	5	52	10	CB	CB
	5	8	8	11	11	AE	AE	9	12	✓	12	71	10	PD	PD
	6	19	15	19	18	✓/AE	✓/AE	11	15	✓/AE	13	110	10	CB	CB
	7														
	totals	34	29	36	36	6	1	24	32	5	30	233	10		MG
Merrimack River Control		A	B	C	D	E	F	G	H	I	J				
	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	4	5	5	4	7	6	7	5	6	6	5	56	10		
	5	13	18	12	12	13	13	12	13	12	16	134	10		
	6	3	6	8	6	5	13	7	✓	7	9	64	10		
	7														
totals	21	29	24	25	24	33	24	19	25	30	254	10			
6.25%		A	B	C	D	E	F	G	H	I	J				
	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	4	5	4	✓	2	2	4	2	4	1	4	28	10		
	5	12	10	8	16	8	11	11	8	11	10	105	10		
	6	✓	✓	✓	✓	✓	✓	✓	2	✓	✓	2	10		
	7														
totals	17	14	8	18	10	15	13	14	12	14	135	10			

Notes:

AE = aborted eggs noted

NEW ENGLAND BIOASSAY - CHRONIC TOXICITY TEST BROOD DATA SHEET

FACILITY NAME & ADDRESS:	Lowell Regional Wastewater Utilities First Street Boulevard, Lowell, MA 01850		
NEB PROJECT NUMBER:	05.0044476.00	ORGANISM: <i>Ceriodaphnia dubia</i>	START DATE: 7/11/17

Effluent Concentration	Day Number	Replicate										Total Live Young	# Live Adults	Analyst- Transfer	Analyst- Counts
		A	B	C	D	E	F	G	H	I	J				
12.5%	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	4	5	7	4	7	6	6	2	6	5	✓	48	10		
	5	9	✓	10	✓	11	10	11	9	11	11	82	10		
	6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓/x	0	9		
	7														
	totals	14	7	14	7	17	16	13	15	16	11	130	9		
25%		A	B	C	D	E	F	G	H	I	J				
	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	✓	✓	✓	✓	✓	✓	4	✓	✓	✓	4	10		
	4	5	4	✓	4	3	✓	✓	5	4	4	29	10		
	5	12	2	10	10	14	4	7	9	8	6	82	10		
	6	✓	✓	1	1	1	✓	3	1	✓	✓	7	10		
	7														
	totals	17	6	11	15	18	4	14	15	12	10	122	10		
50%		A	B	C	D	E	F	G	H	I	J				
	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	✓	✓	4	✓	✓	✓	✓	✓	✓	✓	4	10		
	4	6	5	✓	3	3	✓	5	5	6	✓	33	10		
	5	12	12	10	12	6	12	10	9	10	11	104	10		
	6	✓	✓	✓/x	✓	✓	✓	✓	2	✓	✓	2	9		
	7														
	totals	18	17	14	15	9	12	15	16	16	11	143	9		
100%		A	B	C	D	E	F	G	H	I	J				
	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓/x	✓	0	9		
	3	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	0	9		
	4	3	2	3	3	4	4	6	4	X	2	31	9		
	5	4	4	4	✓	6	5	4	4	X	4	35	9		
	6	✓	✓	✓	✓	4	1	✓	✓	X	✓	5	9		
	7														
	totals	7	6	7	3	14	10	10	8	0	6	71	9		

Ceriodaphnia 7-d Survival and Reproduction Test

New England Bioassay

Analysis ID: 14-6471-9849	Endpoint: 2d Survival Rate	CETIS Version: CETISv1.9.2
Analyzed: 18 Jul-17 9:17	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes
Batch ID: 18-0642-2767	Test Type: Reproduction-Survival (7d)	Analyst:
Start Date: 11 Jul-17 11:18	Protocol: EPA/821/R-02-013 (2002)	Diluent: Laboratory Water
Ending Date: 17 Jul-17 11:11	Species: Ceriodaphnia dubia	Brine: Not Applicable
Duration: 6d	Source: In-House Culture	Age: <24h
Sample ID: 17-9925-5940	Code: 6B3E7784	Client: New England Testing Labs
Sample Date: 09 Jul-17	Material: WWTF Effluent	Project:
Receipt Date: 10 Jul-17 16:15	Source: Lowell RWWU (MA0100633)	
Sample Age: 59h	Station:	

Linear Interpolation Options					
X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X)	Linear	1148858	200	Yes	Two-Point Interpolation

Point Estimates						
Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC50	>100	n/a	n/a	<1	n/a	n/a

2d Survival Rate Summary			Calculated Variate(A/B)								
Conc-%	Code	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
0	D	10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
6.25		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
12.5		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
14		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
25		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
50		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
100		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10

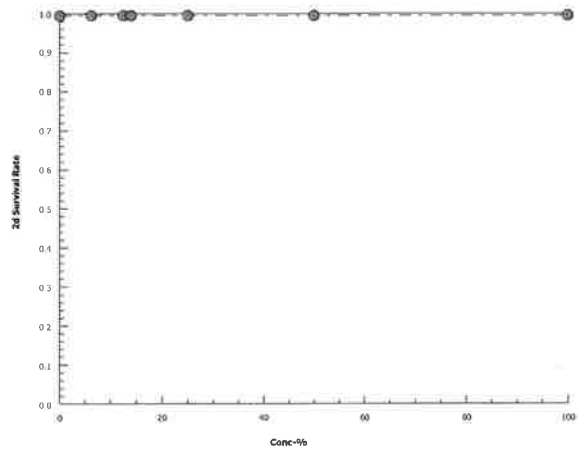
2d Survival Rate Detail											
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6.25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
14		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

2d Survival Rate Binomials											
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
6.25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
50		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
100		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	0/1	1/1

Ceriodaphnia 7-d Survival and Reproduction Test New England Bioassay

Analysis ID:	14-6471-9849	Endpoint:	2d Survival Rate	CETIS Version:	CETISv1.9.2
Analyzed:	18 Jul-17 9:17	Analysis:	Linear Interpolation (ICPIN)	Official Results:	Yes

Graphics



CETIS Analytical Report

Report Date: 18 Jul-17 09:24 (p 3 of 6)
Test Code: 17-1015 | 13-8504-4918

Ceriodaphnia 7-d Survival and Reproduction Test

New England Bioassay

Analysis ID: 07-2696-3310	Endpoint: 6d Survival Rate	CETIS Version: CETISv1.9.2
Analyzed: 18 Jul-17 9:17	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes
Batch ID: 18-0642-2767	Test Type: Reproduction-Survival (7d)	Analyst:
Start Date: 11 Jul-17 11:18	Protocol: EPA/821/R-02-013 (2002)	Diluent: Laboratory Water
Ending Date: 17 Jul-17 11:11	Species: Ceriodaphnia dubia	Brine: Not Applicable
Duration: 6d	Source: In-House Culture	Age: <24h
Sample ID: 17-9925-5940	Code: 6B3E7784	Client: New England Testing Labs
Sample Date: 09 Jul-17	Material: WWTF Effluent	Project:
Receipt Date: 10 Jul-17 16:15	Source: Lowell RWWU (MA0100633)	
Sample Age: 59h	Station:	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X)	Linear	1206121	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC50	>100	n/a	n/a	<1	n/a	n/a

6d Survival Rate Summary

Calculated Variate(A/B)

Conc-%	Code	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
0	D	10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
6.25		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
12.5		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
14		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
25		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
50		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
100		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10

6d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6.25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
14		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

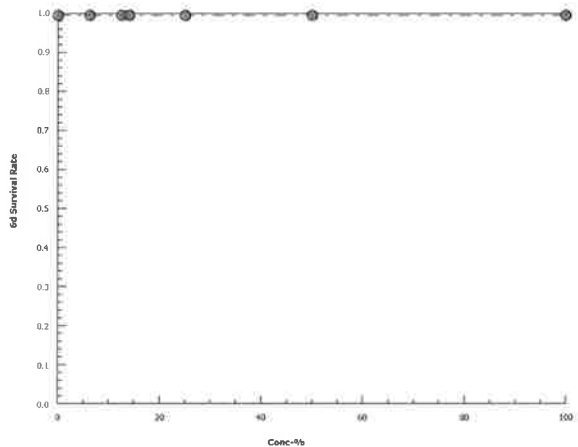
6d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
6.25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
50		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
100		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	0/1	1/1

Ceriodaphnia 7-d Survival and Reproduction Test New England Bioassay

Analysis ID:	07-2696-3310	Endpoint:	6d Survival Rate	CETIS Version:	CETISv1.9.2
Analyzed:	18 Jul-17 9:17	Analysis:	Linear Interpolation (ICPIN)	Official Results:	Yes

Graphics



CETIS Analytical Report

Report Date: 18 Jul-17 09:24 (p 5 of 6)
 Test Code: 17-1015 | 13-8504-4918

Ceriodaphnia 7-d Survival and Reproduction Test

New England Bioassay

Analysis ID: 19-0401-1144	Endpoint: Reproduction	CETIS Version: CETISv1.9.2
Analyzed: 18 Jul-17 9:20	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes
Batch ID: 18-0642-2767	Test Type: Reproduction-Survival (7d)	Analyst:
Start Date: 11 Jul-17 11:18	Protocol: EPA/821/R-02-013 (2002)	Diluent: Laboratory Water
Ending Date: 17 Jul-17 11:11	Species: Ceriodaphnia dubia	Brine: Not Applicable
Duration: 6d	Source: In-House Culture	Age: <24h
Sample ID: 17-9925-5940	Code: 6B3E7784	Client: New England Testing Labs
Sample Date: 09 Jul-17	Material: WWTF Effluent	Project:
Receipt Date: 10 Jul-17 16:15	Source: Lowell RWWU (MA0100633)	
Sample Age: 59h	Station:	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Linear	Linear	1678435	200	Yes	Two-Point Interpolation

Test Acceptability Criteria

		TAC Limits		Overlap	Decision
Attribute	Test Stat	Lower	Upper		
Control Resp	23.3	15	>>	Yes	Passes Criteria

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC25	3.715	2.854	58.43	26.92	1.711	35.03
IC50	62.5	5.709	94.51	1.6	1.058	17.52

Reproduction Summary

Calculated Variate

Conc-%	Code	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	D	10	23.3	1	36	4.374	13.83	59.37%	0.0%
6.25		10	13.5	8	18	0.9458	2.991	22.15%	42.06%
12.5		10	13	7	17	1.135	3.59	27.62%	44.21%
25		10	12.2	4	18	1.444	4.566	37.42%	47.64%
50		10	14.3	9	18	0.895	2.83	19.79%	38.63%
100		10	7.1	0	14	1.224	3.872	54.53%	69.53%

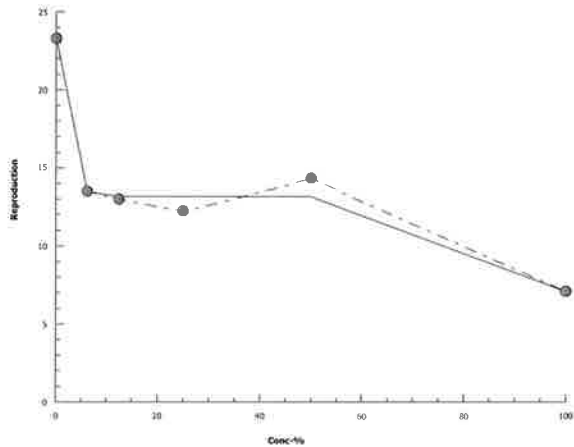
Reproduction Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	34	29	36	36	6	1	24	32	5	30
6.25		17	14	8	18	10	15	13	14	12	14
12.5		14	7	14	7	17	16	13	15	16	11
25		17	6	11	15	18	4	14	15	12	10
50		18	17	14	15	9	12	15	16	16	11
100		7	6	7	3	14	10	10	8	0	6

Ceriodaphnia 7-d Survival and Reproduction Test New England Bioassay

Analysis ID:	19-0401-1144	Endpoint:	Reproduction	CETIS Version:	CETISv1.9.2
Analyzed:	18 Jul-17 9:20	Analysis:	Linear Interpolation (ICPIN)	Official Results:	Yes

Graphics



CETIS Analytical Report

Report Date: 18 Jul-17 09:24 (p 1 of 2)
Test Code: 17-1015 | 13-8504-4918

Ceriodaphnia 7-d Survival and Reproduction Test

New England Bioassay

Analysis ID: 12-7790-5628	Endpoint: 6d Survival Rate	CETIS Version: CETISv1.9.2
Analyzed: 18 Jul-17 9:19	Analysis: STP 2xK Contingency Tables	Official Results: Yes
Batch ID: 18-0642-2767	Test Type: Reproduction-Survival (7d)	Analyst:
Start Date: 11 Jul-17 11:18	Protocol: EPA/821/R-02-013 (2002)	Diluent: Laboratory Water
Ending Date: 17 Jul-17 11:11	Species: Ceriodaphnia dubia	Brine: Not Applicable
Duration: 6d	Source: In-House Culture	Age: <24h
Sample ID: 17-9925-5940	Code: 6B3E7784	Client: New England Testing Labs
Sample Date: 09 Jul-17	Material: WWTF Effluent	Project:
Receipt Date: 10 Jul-17 16:15	Source: Lowell RWWU (MA0100633)	
Sample Age: 59h	Station:	

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU
Untransformed	C > T	100	> 100	n/a	1

Fisher Exact/Bonferroni-Holm Test

Control	vs	Group	Test Stat	P-Type	P-Value	Decision(α:5%)
Dilution Water		6.25	1.0000	Exact	1.0000	Non-Significant Effect
		12.5	0.5000	Exact	1.0000	Non-Significant Effect
		25	1.0000	Exact	1.0000	Non-Significant Effect
		50	0.5000	Exact	1.0000	Non-Significant Effect
		100	0.5000	Exact	1.0000	Non-Significant Effect

Data Summary

Conc-%	Code	NR	R	NR + R	Prop NR	Prop R	%Effect
0	D	10	0	10	1	0	0.0%
6.25		10	0	10	1	0	0.0%
12.5		9	1	10	0.9	0.1	10.0%
25		10	0	10	1	0	0.0%
50		9	1	10	0.9	0.1	10.0%
100		9	1	10	0.9	0.1	10.0%

6d Survival Rate Detail

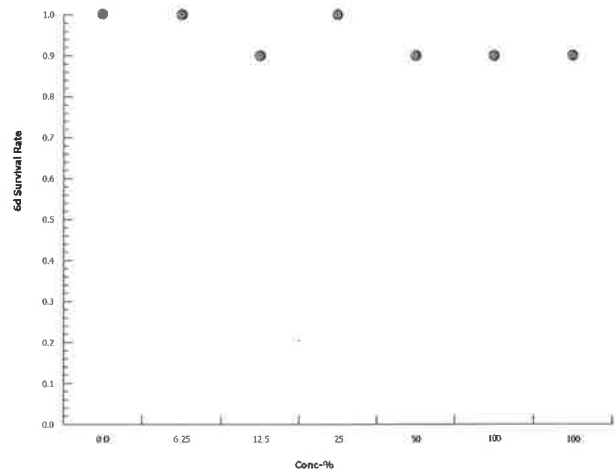
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6.25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000
25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000

6d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
6.25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	0/1
25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
50		1/1	1/1	0/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
100		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	0/1	1/1

Ceriodaphnia 7-d Survival and Reproduction Test			New England Bioassay
Analysis ID:	12-7790-5628	Endpoint:	6d Survival Rate
Analized:	18 Jul-17 9:19	Analysis:	STP 2xK Contingency Tables
		CETIS Version:	CETISv1.9.2
		Official Results:	Yes

Graphics



CETIS Analytical Report

Report Date: 18 Jul-17 09:24 (p 1 of 2)
Test Code: 17-1015 | 13-8504-4918

Ceriodaphnia 7-d Survival and Reproduction Test

New England Bioassay

Analysis ID: 05-2590-6839	Endpoint: Reproduction	CETIS Version: CETISv1.9.2
Analyzed: 18 Jul-17 9:24	Analysis: Parametric-Control vs Treatments	Official Results: Yes
Batch ID: 18-0642-2767	Test Type: Reproduction-Survival (7d)	Analyst:
Start Date: 11 Jul-17 11:18	Protocol: EPA/821/R-02-013 (2002)	Diluent: Laboratory Water
Ending Date: 17 Jul-17 11:11	Species: Ceriodaphnia dubia	Brine: Not Applicable
Duration: 6d	Source: In-House Culture	Age: <24h
Sample ID: 17-9925-5940	Code: 6B3E7784	Client: New England Testing Labs
Sample Date: 09 Jul-17	Material: WWTF Effluent	Project:
Receipt Date: 10 Jul-17 16:15	Source: Lowell RWWU (MA0100633)	
Sample Age: 59h	Station:	

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C > T	< 6.25	6.25	n/a	>16	28.76%

Dunnett Multiple Comparison Test

Control	vs	Control II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Dilution Water		6.25*	3.348	2.289	6.701	18	CDF	0.0033	Significant Effect
		12.5*	3.519	2.289	6.701	18	CDF	0.0020	Significant Effect
		25*	3.792	2.289	6.701	18	CDF	8.8E-04	Significant Effect
		50*	3.075	2.289	6.701	18	CDF	0.0072	Significant Effect
		100*	5.535	2.289	6.701	18	CDF	3.2E-06	Significant Effect

Test Acceptability Criteria

Attribute	Test Stat	Lower	Upper	Overlap	Decision
Control Resp	23.3	15	>>	Yes	Passes Criteria

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1386.2	277.24	5	6.472	8.8E-05	Significant Effect
Error	2313.2	42.837	54			
Total	3699.4		59			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance Test	40.7	15.09	1.4E-07	Unequal Variances
Distribution	Shapiro-Wilk W Normality Test	0.896	0.9459	9.4E-05	Non-Normal Distribution

Reproduction Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	D	10	23.3	13.4	33.2	29.5	1	36	4.374	59.37%	0.00%
6.25		10	13.5	11.36	15.64	14	8	18	0.9458	22.15%	42.06%
12.5		10	13	10.43	15.57	14	7	17	1.135	27.62%	44.21%
25		10	12.2	8.934	15.47	13	4	18	1.444	37.42%	47.64%
50		10	14.3	12.28	16.32	15	9	18	0.895	19.79%	38.63%
100		10	7.1	4.33	9.87	7	0	14	1.224	54.53%	69.53%

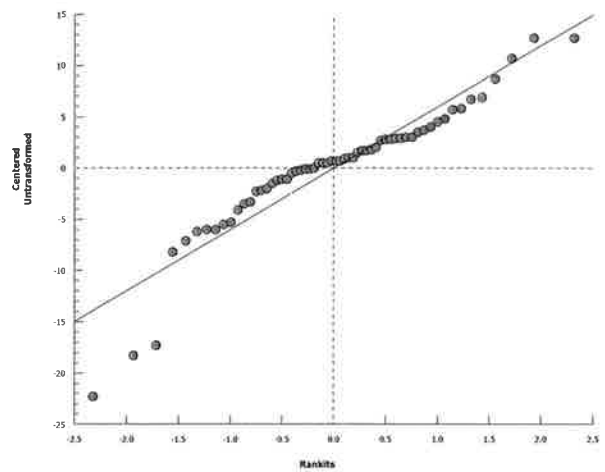
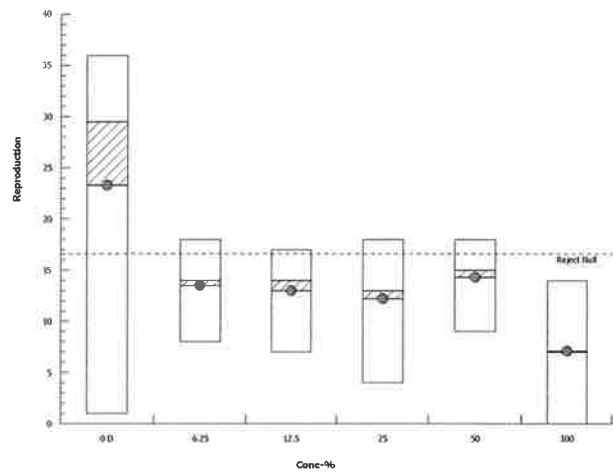
Reproduction Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	34	29	36	36	6	1	24	32	5	30
6.25		17	14	8	18	10	15	13	14	12	14
12.5		14	7	14	7	17	16	13	15	16	11
25		17	6	11	15	18	4	14	15	12	10
50		18	17	14	15	9	12	15	16	16	11
100		7	6	7	3	14	10	10	8	0	6

Ceriodaphnia 7-d Survival and Reproduction Test New England Bioassay

Analysis ID:	05-2590-6839	Endpoint:	Reproduction	CETIS Version:	CETISv1.9.2
Analyzed:	18 Jul-17 9:24	Analysis:	Parametric-Control vs Treatments	Official Results:	Yes

Graphics



NEB'S DATA SHEET FOR ROUTINE CHEMICAL AND PHYSICAL DETERMINATIONS

FACILITY NAME & ADDRESS:		Lowell Regional Wastewater Utilities First Street Boulevard, Lowell, MA 01850						
NEB PROJECT NUMBER:		05.0044476.00			TEST ORGANISM		Ceriodaphnia dubia	
DILUTION WATER SOURCE:		Laboratory Synthetic Soft Water			START DATE:		7/11/17 TIME: 1118	
ANALYST	TBP	KO	CB	ZM	TBP	CB		
NEB Lab Synthetic Diluent	1	2	3	4	5	6	7	Remarks
Temp °C Initial	25.3	25.1	25.4	24.9	25.0	24.9		
D.O. mg/L Initial	7.1	8.2	8.1	8.4	8.2	8.2		
pH s.u. Initial	7.1	7.3	7.6	7.4	7.8	7.7		
Conductivity µS Initial	178	178	176	178	177	178		
Temp °C Final	24.7	24.0	24.7	25.2	24.8	25.6		
D.O. mg/L Final	8.7	9.0	8.2	9.2	8.3	8.5		
pH s.u. Final	8.0	8.6	7.6	8.0	8.0	7.7		
Conductivity µS Final	194	195	210	196	199	196		
Merrimack River Control	1	2	3	4	5	6	7	Remarks
Temp °C Initial	26.0	25.1	25.2	24.8	24.9	25.8		
D.O. mg/L Initial	7.6	8.2	9.2	8.6	8.4	8.5		
pH s.u. Initial	7.1	7.4	7.6	7.5	7.9	7.7		
Conductivity µS Initial	126	132	153	151	165	166		
Temp °C Final	25.0	24.0	24.7	25.3	24.9	25.7		
D.O. mg/L Final	8.8	9.0	8.3	9.1	8.3	8.6		
pH s.u. Final	8.1	8.7	7.6	8.3	7.9	7.8		
Conductivity µS Final	147	143	182	169	190	189		
6.25%	1	2	3	4	5	6	7	Remarks
Temp °C Initial	25.7	25.2	25.3	24.7	25.2	25.2		
D.O. mg/L Initial	7.1	8.5	8.2	9.1	8.2	8.2		
pH s.u. Initial	7.1	7.3	7.6	7.3	7.7	7.6		
Conductivity µS Initial	222	225	228	225	231	222		
Temp °C Final	24.9	24.0	24.6	25.4	24.7	25.8		
D.O. mg/L Final	8.7	8.9	8.3	9.6	8.3	8.6		
pH s.u. Final	8.0	8.7	7.6	9.0	7.8	7.7		
Conductivity µS Final	238	235	245	246	243	239		
12.5%	1	2	3	4	5	6	7	Remarks
Temp °C Initial	25.7	25.2	25.2	25.0	25.2	25.2		
D.O. mg/L Initial	7.1	8.3	8.3	8.6	8.2	8.2		
pH s.u. Initial	7.1	7.3	7.6	7.3	7.7	7.6		
Conductivity µS Initial	262	267	279	275	256	257		
Temp °C Final	24.9	24.0	24.4	25.3	24.6	25.7		
D.O. mg/L Final	9.0	9.5	8.5	9.7	8.4	8.6		
pH s.u. Final	8.3	8.8	7.7	9.1	7.9	7.8		
Conductivity µS Final	272	277	291	290	268	273		

NEB'S DATA SHEET FOR ROUTINE CHEMICAL AND PHYSICAL DETERMINATIONS

FACILITY NAME & ADDRESS:		Lowell Regional Wastewater Utilities First Street Boulevard, Lowell, MA 01850						
NEB PROJECT NUMBER:		05.0044476.00		TEST ORGANISM		Ceriodaphnia dubia		
DILUTION WATER SOURCE:		Laboratory Synthetic Soft Water		START DATE:		7/11/17		TIME: 1118
25%	1	2	3	4	5	6	7	Remarks
Temp °C Initial	25.9	25.1	25.3	25.2	25.3	25.3		
D.O. mg/L Initial	7.2	8.2	8.4	8.4	8.3	8.2		
pH s.u. Initial	7.1	7.3	7.5	7.3	7.6	7.5		* technician error
Conductivity µS Initial	*	359	387	371	340	341		data not recorded
Temp °C Final	24.8	24.0	24.5	25.3	24.6	26.0		
D.O. mg/L Final	9.1	9.3	8.5	9.6	8.4	8.7		
pH s.u. Final	8.3	8.6	7.7	8.8	7.8	7.8		
Conductivity µS Final	369	370	399	380	358	357		
50%	1	2	3	4	5	6	7	Remarks
Temp °C Initial	25.9	25.2	25.2	25.2	25.3	25.5		
D.O. mg/L Initial	7.3	8.2	8.8	8.4	8.3	8.2		
pH s.u. Initial	7.1	7.3	7.5	7.2	7.4	7.4		
Conductivity µS Initial	530	521	583	596	517	511		
Temp °C Final	24.8	24.0	24.5	25.1	24.5	26.0		
D.O. mg/L Final	9.0	9.2	8.4	9.3	8.3	8.7		
pH s.u. Final	8.2	8.5	7.8	8.8	7.8	7.8		
Conductivity µS Final	523	524	592	591	527	517		
100%	1	2	3	4	5	6	7	Remarks
Temp °C Initial	26.0	25.1	25.1	25.3	25.0	26.0		
D.O. mg/L Initial	7.8	8.3	9.5	8.6	8.4	8.2		
pH s.u. Initial	6.9	7.2	7.3	7.1	7.3	7.2		
Conductivity µS Initial	888	875	1,013	1,012	858	845		
Temp °C Final	24.9	24.0	24.5	25.1	24.7	26.0		
D.O. mg/L Final	9.0	9.5	8.4	9.3	8.3	8.8		
pH s.u. Final	8.2	8.5	8.1	8.8	7.8	7.9		
Conductivity µS Final	868	879	1,002	985	858)	845		
	1	2	3	4	5	6	7	Remarks
Temp °C Initial								
D.O. mg/L Initial								
pH s.u. Initial								
Conductivity µS Initial								
Temp °C Final								
D.O. mg/L Final								
pH s.u. Final								
Conductivity µS Final								

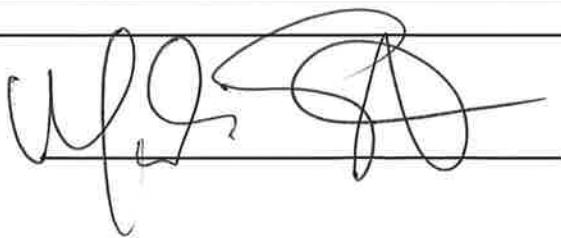
**NEW ENGLAND BIOASSAY
INITIAL CHEMISTRY DATA**

CLIENT: NET - Lowell RWF
 NEB JOB # 05.0044476.00
 TEST ID # C.dubia 17-1015

DATE RECEIVED	7/10/17		7/12/17		7/14/17	
SAMPLE TYPE:	EFF #1	RIVER #1	EFF #2	RIVER #2	EFF #3	RIVER #3
COC #	C37-2675	C37-2676	C37-2724	C37-2725	C37-2784	C37-2785
pH (SU)	6.4	6.4	6.6	6.8	6.4	7.0
Temperature (°C)	5.1	3.8	3.1	3.1	2.4	3.5
Dissolved Oxygen (mg/L)	9.9	9.9	9.6	9.2	10.6	10.8
Conductivity (µmhos)	896	126	1,017	151	884	170
Salinity (ppt)	<1	<1	<1	<1	< 1	< 1
TRC - DPD (mg/L)	0.010	0.012	0.018	0.017	0.016	0.024
TRC - Amperometric (mg/L)	N/A	N/A	N/A	N/A	N/A	N/A
Hardness (mg/L as CaCO ₃)	70	18	74	18	62	20
Alkalinity (mg/l as CaCO ₃)	55	10	80	10	35	15
Tech Initials	PD	PD	ZM	ZM	CW	CW

NOTE: NA = NOT APPLICABLE

Data Reviewed By:



Date Reviewed:

8/9/17

Brood mother source: RMH 118 A-12 Source's brood size: 16 (Qty.)

Lowell 7-11-17

Tech	At	SP	At	At	MS		SP	At		At						
Date	7-3	7-4	7-5	7-6	7-7		7-9	7-10		7-11						
Day acc.	0	1	2	3	4	5	6	7		8	9	10	11	12	13	14
Cup #																
1	N	N	N	N	5		10	Y ^{T10} ₁₆	1	T1 Y ₁₈						
2	N	N	N	N	5		10	Y	2	T2 Y ₁₉						
3	N	N	N	N	6		9	Y	3	T3 Y ₁₇						
4	N	N	N	N	5		10	Y	4	T4 Y ₁₇						
5	N	N	N	N	4		10	Y	5	T5 Y ₁₈						
6	N	N	N	N	5		10	Y	6	T6 Y ₁₇						
7	N	N	N	N	6		9	Y	7	T7 Y ₁₆						
8	N	N	N	N	5		9	Y	8	T8 Y ₁₅						
9	N	N	N	N	4		8	Y	9	T9 Y ₁₇						
10	N	N	N	N	4		10	Y	10	T10 Y ₁₈						
11	N	N	N	N	4		11	Y	11	Y						
12	N	N	N	N	4		11	Y	12	Y						
13	N	N	N	N	4		10	Y	13	Y						

Y = neonates present, and criterion has been met: ≥ 20 neonates produced in total by 3rd brood.

N = no neonates

2B = two broods present. 2Y = two broods and criterion met: ≥ 20 neos. by 3rd brood.

X = brood mother dead ae = aborted eggs

✓ or P = neonates present after renewal on previous day (see time in log).

A→ = acceptable for acute testing only

T# = neonates used in test, replicate number of test noted (and brood counted).

acc. = if acclimated, H₂O type used w/ renewal this day.

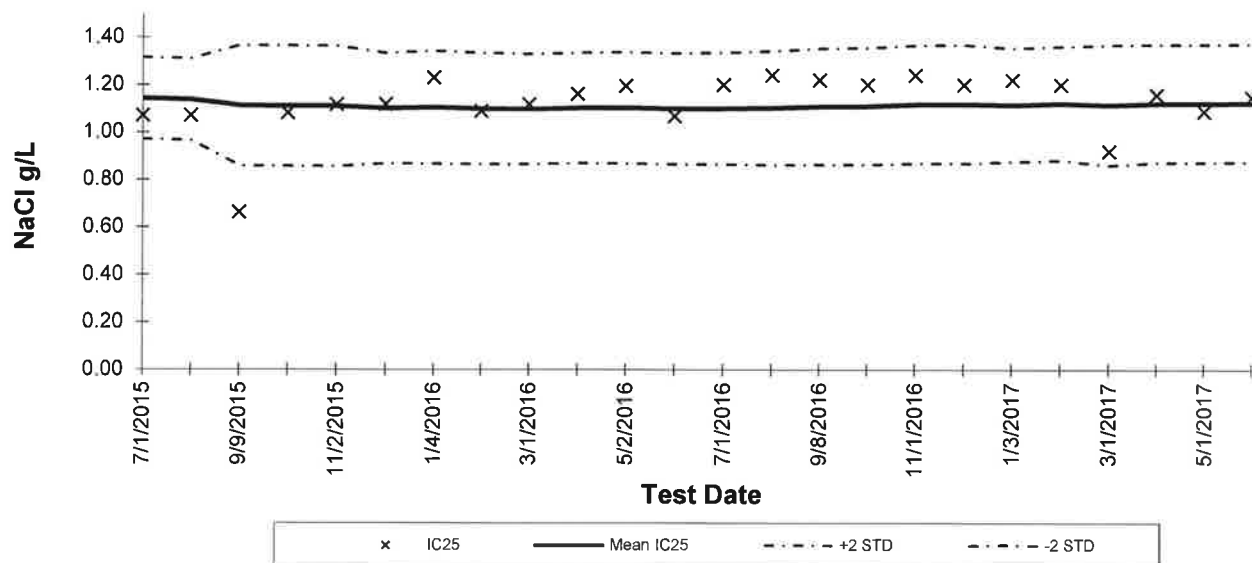
Test organism collection:

Tray diagram
used?

Project #	Symbols (✓ / P)	(Y/N)	Time period, neonates released	Collection date / time
0850801	T	Y	7-9-17/1630 → 7-9-17/1950	7-10-17/1330
0644476	T	Y	7-10-17/2145 → 7-11-17/0630	7-11-17/1045
	T			
	T			
	T			
	T			

New England Bioassay
Reference Toxicant Data: *Ceriodaphia dubia* Chronic Reproduction IC25

Reference Toxicant: Sodium chloride
Test Dates: July 2015 - July 2017



Test ID	Date	IC ₂₅	Mean IC ₂₅	STD	-2STD	+2STD	CV	CV National	CV National
								75th%	90th%
15-955	7/1/2015	1.07	1.14	0.09	0.97	1.32	0.07	0.45	0.62
15-1211	8/3/2015	1.07	1.14	0.09	0.97	1.31	0.08	0.45	0.62
15-1375	9/9/2015	0.66	1.11	0.13	0.86	1.37	0.11	0.45	0.62
15-1540	10/1/2015	1.08	1.11	0.13	0.86	1.37	0.11	0.45	0.62
15-1691	11/2/2015	1.12	1.11	0.13	0.86	1.36	0.11	0.45	0.62
15-1897	12/28/2015	1.12	1.10	0.12	0.87	1.33	0.11	0.45	0.62
16-37	1/4/2016	1.23	1.11	0.12	0.87	1.34	0.11	0.45	0.62
16-138	2/1/2016	1.09	1.10	0.12	0.87	1.34	0.11	0.45	0.62
16-307	3/1/2016	1.12	1.10	0.12	0.87	1.33	0.11	0.45	0.62
16-463	4/1/2016	1.16	1.10	0.12	0.87	1.34	0.11	0.45	0.62
16-596	5/2/2016	1.19	1.10	0.12	0.87	1.34	0.11	0.45	0.62
16-707	6/1/2016	1.07	1.10	0.12	0.87	1.34	0.11	0.45	0.62
16-880	7/1/2016	1.20	1.10	0.12	0.87	1.34	0.11	0.45	0.62
16-1212	8/24/2016	1.24	1.10	0.12	0.86	1.34	0.11	0.45	0.62
16-1258	9/8/2016	1.22	1.11	0.12	0.87	1.35	0.11	0.45	0.62
16-1553	10/24/2016	1.20	1.11	0.12	0.87	1.36	0.11	0.45	0.62
16-1592	11/1/2016	1.24	1.12	0.12	0.87	1.37	0.11	0.45	0.62
16-1734	12/1/2016	1.20	1.12	0.13	0.87	1.37	0.11	0.45	0.62
17-14	1/3/2017	1.22	1.12	0.12	0.88	1.36	0.11	0.45	0.62
17-151	2/1/2017	1.20	1.12	0.12	0.88	1.36	0.11	0.45	0.62
17-267	3/1/2017	0.92	1.12	0.13	0.86	1.37	0.11	0.45	0.62
17-480	4/3/2017	1.16	1.12	0.12	0.87	1.37	0.11	0.45	0.62
17-616	5/1/2017	1.09	1.12	0.12	0.88	1.37	0.11	0.45	0.62
17-972	7/5/2017	1.15	1.13	0.12	0.88	1.37	0.11	0.45	0.62

Results:

Sample: Plt Eff
7G10069-01 (Water)

General Chemistry

	Result	Reporting Limit	Units	Date Analyzed
Alkalinity as CaCO₃	56	2	mg/L	07/13/17
Ammonia	3.6	0.1	mg/L	07/13/17
pH	6.9	0.1	SU	07/10/17 18:00
Specific Conductance	856	1	uS/cm	07/14/17
Total Dissolved Solids	468	10	mg/L	07/11/17
Total Organic Carbon	6.6	1.0	mg/L	07/17/17
Total Residual Chlorine	0.12	0.01	mg/L	07/11/17 11:06
Total solids (TS)	484	10	mg/L	07/11/17
Total Suspended Solids	5	2	mg/L	07/11/17

Total Metals

	Result	Reporting Limit	Units	Date Analyzed
Calcium	22.8	0.01	mg/L	07/13/17
Magnesium	3.86	0.01	mg/L	07/13/17
Cadmium	ND	0.0001	mg/L	07/12/17
Lead	ND	0.0002	mg/L	07/13/17
Aluminum	0.081	0.012	mg/L	07/13/17
Copper	0.009	0.005	mg/L	07/13/17
Nickel	0.003	0.001	mg/L	07/13/17
Zinc	0.059	0.005	mg/L	07/13/17
Total Hardness	72.9	0.0312	mg/L	07/13/17

Sample: Receiving Water
7G10069-02 (Water)

General Chemistry

	Result	Reporting Limit	Units	Date Analyzed
Alkalinity as CaCO₃	7	2	mg/L	07/13/17
Ammonia	0.2	0.1	mg/L	07/13/17
pH	7.2	0.1	SU	07/10/17 18:00
Specific Conductance	118	1	uS/cm	07/14/17
Total Dissolved Solids	72	10	mg/L	07/11/17
Total Organic Carbon	4.6	1.0	mg/L	07/17/17
Total Residual Chlorine	0.02	0.01	mg/L	07/11/17 11:06
Total solids (TS)	92	10	mg/L	07/11/17
Total Suspended Solids	2	2	mg/L	07/11/17

Sample: Receiving Water (Continued)
7G10069-02 (Water)

Total Metals

	Result	Reporting Limit	Units	Date Analyzed
Calcium	5.20	0.01	mg/L	07/13/17
Magnesium	0.93	0.01	mg/L	07/13/17
Cadmium	ND	0.0001	mg/L	07/12/17
Lead	0.003	0.0002	mg/L	07/13/17
Aluminum	0.344	0.012	mg/L	07/13/17
Copper	0.005	0.005	mg/L	07/13/17
Nickel	0.002	0.001	mg/L	07/13/17
Zinc	0.024	0.005	mg/L	07/13/17
Total Hardness	16.8	0.0312	mg/L	07/13/17

NEW ENGLAND BIOASSAY CHAIN-OF-CUSTODY

EFFLUENT

Sampler: JIN BOE MCGOWAN
 Title: CHEMIST
 Facility: Lowell Regional Wastewater Utilities

Sampling Method: X Composite

Sample ID: _____
 Start Date: 07-09-2017 Time: 00:00
 End Date: 07-09-2017 Time: 24:00

Sampling Method: _____ Grab (for pH and TRC only _____)

Date Collected: _____
 Time Collected: _____

Sample Type: _____
☒ Prechlorinated
☐ Dechlorinated
☐ Unchlorinated
☐ Chlorinated

Effluent Sampling Location and Procedures: Plant outfall after dechlorination. 24 hr. composite.

Receiving Water Sampling Location and Procedures: Merrimack River upstream of the plant discharge at the Hunts Fall Bridge, (Rt.38)

Requested Analysis: X Chronic and modified acute

Sample Shipment

Method of Shipment: New England Testing Labs

Relinquished By: <u>J. Shea</u>	Date: <u>7/10/17</u>	Time: <u>12:25 PM</u>
Received By: <u>[Signature]</u>	Date: <u>7/10/17</u>	Time: <u>12:25 PM</u>
Relinquished By: <u>[Signature]</u>	Date: <u>7/10/17</u>	Time: <u>3:10 PM</u>
Received By: <u>[Signature]</u>	Date: <u>7-10-17</u>	Time: <u>15:10</u>
Relinquished By: <u>[Signature]</u>	Date: <u>7-10-17</u>	Time: <u>16:15</u>
Received By: <u>[Signature]</u>	Date: <u>7/10/17</u>	Time: <u>16:15</u>

FOR NEB USE ONLY

* Please return all ice packs NEB has provided to insure accurate temperature upon receipt to the NEB laboratory *

Temperature of Effluent Upon Receipt at Lab: 5.1 °C

Temperature of Receiving Water Upon Receipt at Lab: 3.8 °C

Effluent COC# C37-2675

Receiving Water COC# C37-2676

IF THIS COOLER IS MISPLACED OR THE LABEL IS LOST, PLEASE SHIP TO:
 KIM WILLS, NEW ENGLAND BIOASSAY, 77 BATSON DRIVE, MANCHESTER CT 06042

NEW ENGLAND BIOASSAY CHAIN-OF-CUSTODY

EFFLUENT

Sampler: JIN BOK M'GOWAN
 Title: CHEMIST
 Facility: Lowell Regional Wastewater Utilities

Sampling Method: ☒ Composite

Sample ID: _____

Start Date: 7-11-2017 Time: 00:00

End Date: 7-11-2017 Time: 24:00

Sampling Method: _____ Grab (for pH and TRC only _____)

Date Collected: _____

Time Collected: _____

Sample Type: _____
☒ Prechlorinated
☒ Dechlorinated
☐ Unchlorinated
☐ Chlorinated

Effluent Sampling Location and Procedures: Plant outfall after dechlorination. 24 hr. composite.

Receiving Water Sampling Location and Procedures: Merrimack River upstream of the plant discharge at the Hunts Fall Bridge, (Rt.38)

Requested Analysis: ☒ Chronic and modified acute

Sample Shipment

Method of Shipment: New England Testing Labs

Relinquished By: <u>[Signature]</u>	Date: <u>7-12-17</u>	Time: <u>11:28</u>
Received By: <u>[Signature]</u>	Date: <u>7.12.17</u>	Time: <u>1125</u>
Relinquished By: <u>[Signature]</u>	Date: <u>7/12/17</u>	Time: <u>1500</u>
Received By: <u>Chris Ryan</u>	Date: <u>7.12.17</u>	Time: <u>1530</u>
Relinquished By: <u>[Signature]</u>	Date: <u>7.12.17</u>	Time: <u>1617</u>
Received By: <u>[Signature]</u>	Date: <u>7/12/17</u>	Time: <u>1617</u>

FOR NEB USE ONLY

* Please return all ice packs NEB has provided to insure accurate temperature upon receipt to the NEB laboratory *

Temperature of Effluent Upon Receipt at Lab: 3.1 °C

Temperature of Receiving Water Upon Receipt at Lab: 3.1 °C

Effluent COC# 037-2724

Receiving Water COC# 037-2725

IF THIS COOLER IS MISPLACED OR THE LABEL IS LOST, PLEASE SHIP TO:
 KIM WILLS, NEW ENGLAND BIOASSAY, 77 BATSON DRIVE, MANCHESTER CT 06042

NEW ENGLAND BIOASSAY CHAIN-OF-CUSTODY

EFFLUENT

Sampler: JIN-BOK MCGOWAN
 Title: CHEMIST
 Facility: Lowell Regional Wastewater Utilities

Sampling Method: X Composite

Sample ID: _____
 Start Date: 7-13-17 Time: 00:00
 End Date: 7-13-17 Time: 24:00

Sampling Method: _____ Grab (for pH and TRC only _____)

Date Collected: _____
 Time Collected: _____

Sample Type: _____ Prechlorinated
X Dechlorinated
 _____ Unchlorinated
 _____ Chlorinated

Effluent Sampling Location and Procedures: Plant outfall after dechlorination. 24 hr. composite.

Receiving Water Sampling Location and Procedures: Merrimack River upstream of the plant discharge at the Hunts Fall Bridge, (Rt.38)

Requested Analysis: X Chronic and modified acute

Received
ON ICE

Sample Shipment

Method of Shipment: New England Testing Labs

Relinquished By: <u>[Signature]</u>	Date: <u>7/14/17</u>	Time: <u>11:40 AM</u>
Received By: <u>[Signature]</u>	Date: <u>7/14/17</u>	Time: <u>11:40 am</u>
Relinquished By: <u>[Signature]</u>	Date: <u>7/14/17</u>	Time: <u>3:00</u>
Received By: <u>Mike Hodges</u>	Date: <u>7-14-17</u>	Time: <u>15:00</u>
Relinquished By: <u>[Signature]</u>	Date: <u>7-14-17</u>	Time: <u>16:05</u>
Received By: <u>[Signature]</u>	Date: <u>7/14/17</u>	Time: <u>16:05</u>

FOR NEB USE ONLY

* Please return all ice packs NEB has provided to insure accurate temperature upon receipt to the NEB laboratory *

Temperature of Effluent Upon Receipt at Lab: 2.4 °C

Temperature of Receiving Water Upon Receipt at Lab: 3.5 °C

Effluent COC# C37-2784

Receiving Water COC# C37-2785

IF THIS COOLER IS MISPLACED OR THE LABEL IS LOST, PLEASE SHIP TO:
 KIM WILLS, NEW ENGLAND BIOASSAY, 77 BATSON DRIVE, MANCHESTER CT 06042